503.36712VX1

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Applicants:	K. IRIE, et al.
Application. No.	09/855,673
Filed:	MAY 16, 2001
For:	A METHOD FOR PROCESSING PERFLUOROCARBON, AND AN APPARATUS THEREFOR
Group AU:	1725
Examiner:	Kevin P. Kearns
Confirm. No.:	2143

BRIEF ON APPEAL

Mail Stop: APPEAL BRIEF
Honorable Commissioner of
Patent and Trademarks
P.O. Box 1450
Alexandria, VA 22313-1450

November 1, 2005

Sir:

This appeal is from the Examiner's decision in the Final Office Action mailed March 1, 2005, finally rejecting claims 1-24.

REAL PARTY IN INTEREST

The real parties in interest for the above-identified application are Hitachi, Ltd., Hitachi Engineering Co., Ltd. and Hitachi Kyowa Engineering Co., Ltd., the Assignment having been recorded at the U.S. Patent and Trademark Office at Reel 9591, Frame 0415.

RELATED APPEALS AND INTERFERENCES

Attention is respectfully directed to the appeal in connection with Application No. 10/244,010, filed September 16, 2002, in which a Notice of Appeal was filed on

September 21, 2005. No. 10/244,010 is a Continuation-in-part application, and claims benefit under 35 USC 120, of Application No. 09/190,853, filed November 12, 1998, No. 09/190,853 being relied upon under 35 USC 120 in the above-identified application. Upon information and belief, the appeal in connection with No. 10/244,010 is the only prior or pending appeal, interference, or judicial proceeding which may be related to, directly affect or be directly affected by or have a bearing on the Board's decision in this appeal.

STATUS OF CLAIMS

Claims 1-24 are pending in the above-identified application and are all finally rejected. The final rejection of each of claims 1-24 is being appealed herein. Claims 1-24 are the only pending claims in the above-identified application, and there are no allowed, withdrawn or cancelled claims.

Claim 22, in addition to being rejected, was also objected to in the Final Office Action mailed March 1, 2005. As discussed infra in connection with amendments filed subsequent to final rejection, such objection to claim 22 in the Final Office Action mailed March 1, 2005, should be overcome upon entry of the Amendment filed concurrently herewith.

In summary, claims 1-24 are the only claims presently pending in the above-identified application and that have ever been pending in the above-identified application, are all finally rejected, and the final rejection of each of claims 1-24 is being appealed herein.

STATUS OF AMENDMENTS

The only Amendment filed after the Final Office Action mailed March 1, 2005, is an Amendment filed concurrently with this Brief. As this Amendment filed concurrently with this Brief only amends claim 22 as suggested by the Examiner in Item 1 on page 2 of the Final Office Action mailed March 1, 2005, it is expected that this concurrently filed Amendment will be entered herein.

Note that in the enclosed Claims Appendix, claim 22 is set forth as amended in the Amendment filed concurrently herewith.

SUMMARY OF CLAIMED SUBJECT MATTER

Of presently pending claims 1-24, claims 1, 15, 17, 19, 21, 22, 23 and 24 are independent claims. Claims 1, 17, 19, 21, 23 and 24, and claims dependent thereon, are directed to a perfluoride compound processing apparatus; claim 15 and the claim dependent thereon are directed to an exhaust gas processing apparatus for a semiconductor manufacturing apparatus; and claim 22 is directed to a perfluoride compound processing apparatus for a semiconductor manufacturing apparatus.

Each of the independent claims recites that the apparatus includes a silicon component removing apparatus for removing a silicon component from an exhaust gas containing a perfluoride compound and the silicon component, with claims 19 and 24 additionally reciting that this apparatus is for removing the silicon component from such exhaust gas, exhausted from a semiconductor manufacturing apparatus. Each of the independent claims also recites that the apparatus additionally includes a heating apparatus for heating the exhaust gas containing the perfluoride compound, to which at least one of water and steam is added after the exhaust gas

has been exhausted from the silicon component removing apparatus; a catalyst layer filled with a catalyst for decomposing the perfluoride compound contained in the exhaust gas exhausted from the heating apparatus; and a cooling apparatus, located below the catalyst layer, for cooling the exhaust gas exhausted from the catalyst layer.

Independent claim 17 additionally recites that the heating apparatus is arranged in a casing; that the catalyst layer is arranged detachably in the casing at a downstream side of the heating apparatus in the direction of flow of the exhaust gas; and that the cooling apparatus is arranged in the casing at a downstream side from the catalyst layer, in the direction of flow of the exhaust gas, for cooling exhaust gas containing a decomposed gas generated by decomposition of the perfluoride compound by the catalyst layer.

Claim 19 also additionally recites that the heating apparatus is arranged in a casing; that the catalyst layer is arranged detachably in the casing at a downstream side of the heating apparatus in the direction of flow of the exhaust gas; and that the cooling apparatus is arranged in the casing below the catalyst layer, in the direction of flow of the exhaust gas, for cooling the exhaust gas containing a decomposed gas generated by decomposition of the perfluoride compound by the catalyst layer.

Claim 21 additionally recites a cooling water supplying apparatus for supplying cooling water to the silicon component removing apparatus for contacting with the exhaust gas, the cooling water having been supplied to the cooling apparatus and used for cooling the exhaust gas. Claims 22, 23 and 24 also recite this cooling water supplying apparatus.

Each of claims 23 and 24 also recites that the heating apparatus is arranged in a casing; that the catalyst layer is arranged detachably in the casing at a

downstream side of the heating apparatus in the direction of flow of the exhaust gas; and that the cooling apparatus is arranged in the casing at a portion below the catalyst layer in the direction of flow of the exhaust gas.

In connection with the apparatus components recited in the independent claims, note, for example, Fig. 3 and the description in connection therewith bridging pages 14 and 15 of Appellants' specification. Thus, the perfluorocarbon (PFC) processing apparatus includes silicon remover 2, a heating apparatus 3, a reactor 9 containing catalyst layer 11, and a cooling apparatus 22, among other components.

Moreover, as seen in Fig. 5 and as described in the paragraph bridging pages 16 and 17 of Appellants' specification, the PFC decomposition processing unit 76 can include a heating apparatus 3, a reactor 9 and a cooling apparatus 22 enclosed in a casing 6. As can be appreciated, the cooling apparatus 22 is located below the catalyst layer 11 (in Fig. 5, the reactor 9 comprises a catalyst cartridge 10 containing a catalyst layer 11), as described in the paragraph bridging pages 17 and 18 of Appellants' specification.

Of the remaining claims on appeal, that is, claims 2-14, 16, 18 and 20, claims 2-14 are ultimately dependent on claim 1; and claims 16, 18 and 20 are respectively dependent on claims 15, 17 and 19.

Of these dependent claims, claims 18 and 20 recite that the heating apparatus is arranged in an upper region of the casing; the catalyst layer is arranged in a lower region of the casing in a manner that the catalyst layer is removable in a lower direction from the casing, and the cooling apparatus is arranged detachably in the casing at the lower region of the casing. Note Fig. 5 and the description in connection therewith bridging pages 16 and 17 of Appellants' specification. Note also Fig. 7 and the description at page 24, line 10 to page 25, line 22.

Claim 16, dependent on claim 15, recites that the heating apparatus, catalyst layer and cooling apparatus are formed in an integral body structure in order, with this integral boding structure being installed in a building where the semiconductor manufacturing apparatus is installed. Note Fig. 2, and the corresponding description in the paragraph bridging pages 13 and 14 of Appellants' specification.

Claims 2 and 3, each dependent on claim 1, define further structure of the processing apparatus. Claim 2 defines a temperature detector for detecting a temperature of the exhaust gas exhausted from the catalyst layer, and a controller for controlling the heating apparatus based on the temperature detected by the temperature detector; and claim 3 defines an acidic gas removing apparatus for removing acidic gas contained in the exhaust gas exhausted from the cooling apparatus. Note, in connection with the subject matter of claim 2, Fig. 3 and the description in the paragraph bridging pages 18 and 19 of Appellants' specification, particularly temperature control apparatus 62 and thermometer 61. In connection with the acidic gas removing apparatus of claim 3, note, for example, Fig. 3 and the disclosure of acidic gas removing apparatus 98.

Claims 4 and 5, dependent respectively on claims 1 and 4, respectively recites that the silicon component removing apparatus includes a spray apparatus for spraying water, and that the cooling apparatus includes a spray apparatus for spraying cooling water for cooling the exhaust gas. Note, for example, spray apparatus 26 in the Fig. 4, and the description in connection therewith in the first full paragraph on page 15 of Appellants' specification (note particularly spray 26); and in connection with the cooling apparatus including a spray apparatus, note, for example, Fig. 3 and sprays 24 and 25 in cooling apparatus 22, described in the sole full paragraph on page 18 of Appellants' specification. Claim 6, dependent on claim

5, further defines the silicon component removing apparatus as including first and second silicon component removing apparatuses, with first and second spray apparatuses. In connection with claim 6, note from page 8, line 12 through page 9, line 13, of Appellants' specification; see also Fig. 8 and the description in connection therewith in the paragraph bridging pages 26 and 27 of Appellants' specification, including silicon removers 2 and 72, with the silicon remover 72 including a spray 73.

Claims 7 and 8, each dependent on claim 1, respectively recites that the apparatus further includes a check valve for preventing the exhaust gas from flowing back into the silicon component removing apparatus from the heating apparatus, provided in a path conducting the exhaust gas from the silicon component removing apparatus to the heating apparatus; and recites that the heater, catalyst layer and cooling apparatus are formed in an integral body structure in order. In connection with the subject matter of claim 7, note, for example, ball check valve 27 provided at the exhaust gas outlet portion of the silicon remover 2, shown in Fig. 4 and described on page 16, lines 13-20, of Appellants' specification. In connection with the subject matter of claim 8, note heating apparatus 3, reactor 9 and cooling apparatus 22 as seen in Fig. 5, and described in the paragraph bridging pages 16 and 17 of Appellants' specification. Claim 8, dependent on claim 1, recites the integral body structure in terms of how such integral body structure is provided.

Claims 10 and 11, each dependent on claim 1, respectively recites that the structure additionally includes a heat exchanger for exchanging heat between the exhaust gas exhausted from the catalyst layer and water, and for generating steam, provided between the catalyst layer and cooling apparatus; and recites that the apparatus includes a cartridge having the catalyst layer formed inside, and a casing wherein the cartridge is removably attached, the heater, casing and cooling

apparatus being formed in an integral body structure in order. Note the paragraph bridging pages 16 and 17, and the paragraph bridging pages 17 and 18, of Appellants' specification, particularly together with Fig. 5. Note catalyst cartridge 10 and casing 6. As for the heat exchanger, see Fig. 14 and heat exchanger 93, and the description in connection therewith in the sole full paragraph on page 35 of Appellants' specification.

Claims 12 and 13, dependent respectively on claims 11 and 14, respectively recites that the apparatus also includes a reactor which includes the above-mentioned cartridge having the catalyst layer, an internal tube where the cartridge is contained, and the casing, this casing being shared with a casing of the heater; and recites that an exhaust gas in a portion for supplying the exhaust gas containing the perfluoride compound and a silicon component to the silicon component removing apparatus is extended into this removing apparatus, with a gas outlet opening thereof being provided at a position lower than the spray apparatus of the silicon component removing apparatus, this gas outlet opening being oriented downwards in the silicon component removing apparatus. In connection with claim 12, note, for example, Fig. 5 and the description in connection therewith bridging pages 16 and 17 of Appellants' specification, and in particular reactor 9, cartridge 10 and casing 6. In connection with the subject matter of claim 13, note, for example, Fig. 4 and the description in connection therewith in the first full paragraph on page 15 of Appellants' specification, including exhaust gas outlet of the piping 29 provided at a position lower than the spray apparatus 26 of the silicon component removing apparatus. Claim 14, dependent on claim 13, defines further structure of a diffusion portion for diffusing sprayed water from the spray apparatus. Note, for example, Fig. 4 and diffusion portion 97 shown therein, together with the description in

connection with Fig. 4 in the first full paragraph on page 15 of Appellants' specification.

GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

A first ground of rejection to be reviewed on appeal is the rejection of claims 1, 3-8, 15, 16, 21 and 22 under 35 USC 103(a) as being unpatentable over the teachings of U.S. Patent No. 6,069,291 to Rossin, et al. in view of the teachings of U.S. Patent No. 6,030,591 to Tom, et al.

A second ground of rejection presented for review on appeal is the rejection of claim 10 under 35 USC 103(a) as being unpatentable over the teachings of Rossin, et al. in view of the teachings of Tom, et al., as referred to previously, and further in view of the teachings of U.S. Patent No. 5,649,985 to Imamura or of U.S. Patent No. 6,022,489 to Izumikawa, et al.

A third ground of rejection presented for review on appeal is the rejection of claims 13 and 14 under 35 USC 103(a) as being unpatentable over the teachings of Rossin, et al. in view of the teachings of Tom, et al., referred to previously, and further in view of the teachings of U.S. Patent No. 5,955,037 to Holst, et al.

A fourth ground of rejection presented for review on appeal is the rejection of claims 2, 11, 12, 17-20, 23 and 24 under 35 USC 103(a) as being unpatentable over the teachings of Rossin, et al., in view of the teachings ofTom, et al., as discussed previously, and further in view of the teachings of U.S. Patent No. 5,417,934 to Smith, et al.

ARGUMENT

Rejection of Claims 1, 3-8, 15, 16, 21 and 22 Under 35 USC 103(a) as Unpatentable over the Teachings of Rossin, et al. in view of Tom, et al.

It is respectfully submitted that the teaching of Rossin, et al. and Tom, et al. would not have been properly combinable, as discussed infra.

In any event, it is respectfully submitted that the combined teachings of Rossin, et al. and of Tom, et al. would have neither taught nor would have suggested the presently claimed apparatus, including, inter alia, the silicon component removing apparatus for removing a silicon component from an exhaust gas containing a perfluoride compound and the silicon component, especially together with a heating apparatus for heating the exhaust gas to which at least one of water and steam is added after the exhaust gas has been exhausted from the silicon component removing apparatus, a catalyst layer to decompose fluoride in exhaust gas exhausted from the heating apparatus, and a cooling apparatus, as in the present claims, with the cooling apparatus located below the catalyst layer for cooling the exhaust gas exhausted from the catalyst layer. See claim 1; note also claims 21 and 22.

In addition, it is respectfully submitted that the combined teachings of Rossin, et al. and of Tom, et al. would have neither disclosed nor would have suggested such perfluoride compound processing apparatus as in the present claims, having the silicon component removing apparatus and, inter alia, cooling apparatus located below the catalyst layer, and wherein the apparatus further includes a cooling water supplying apparatus for supplying cooling water to the silicon component removing apparatus for contacting with the exhaust gas, the cooling water having been supplied to the cooling apparatus and used for cooling the exhaust gas. See

claims 21 and 22.

Moreover, it is respectfully submitted that the teachings of Rossin, et al. and of Tom, et al. would have neither taught nor would have suggested features of the presently claimed invention having structure as discussed previously in connection with claim 1, and, additionally, wherein the apparatus further includes an acidic gas removing apparatus for removing acidic gas contained in the exhaust gas exhausted from the cooling apparatus (see claim 3); and/or wherein the silicon component removing apparatus includes a spray apparatus for spraying water (see claim 4); and/or wherein the cooling apparatus includes a spray apparatus for spraying cooling water for cooling the exhaust gas (see claim 5); and/or the components of the silicon component removing apparatus as in claim 6; and/or wherein the apparatus includes a check valve for preventing the exhaust gas from flowing back into the silicon component removing apparatus from the heating apparatus, provided in a path conducting the exhaust gas from the silicon component removing apparatus to the heating apparatus (see claim 7); and/or wherein the heater, catalyst layer and cooling apparatus are formed in an integral body structure in order (see claim 8).

Furthermore, it is respectfully submitted that the combined teachings of Rossin, et al. and Tom, et al. would have neither disclosed nor would have suggested the presently claimed subject matter, having features as discussed previously in connection with claim 15, and additionally wherein the heating apparatus, catalyst layer and cooling apparatus are formed in an integral body structure, with the integral body structure being installed in a building where the semiconductor manufacturing apparatus is installed. See claim 16.

The invention as claimed in the above-identified application is directed to an apparatus for processing perfluorocarbons (PFCs), for example, contained in an exhaust gas from a semiconductor manufacturing plant.

In known semiconductor manufacturing processes, various uses are made of PFC gasses, and it is necessary to remove the PFCs from exhaust gasses used in semiconductor manufacturing processes, in order to avoid adverse effects on the environment.

As described in the paragraph bridging pages 6 and 7 of Appellants' specification, a method of decomposing chlorofluorocarbons using a catalyst has been described. In this method, a mixed gas of heated air, which is made of a carrier gas, steam and the chlorofluorocarbon is conducted to a catalyst layer, and the exhaust gas containing decomposed gasses exhausted out of the catalyst layer is cooled rapidly with cooling water.

However, as found by Appellants, in treating exhaust gasses from semiconductor manufacturing processes, a problem arises in treating such exhaust gasses. That is, a closing of the pores formed on the catalyst by solid particles generated by a reaction of the silicon components in the exhaust gas with water or steam added to the exhaust gas occurs.

Appellants address this problem of closing of the pores, and avoid this problem by incorporating a silicon component removing apparatus for removing a silicon component from an exhaust gas containing a perfluoride compound and the silicon component, wherein any one of water and steam is added after the exhaust gas has been exhausted from the silicon component removing apparatus; and, moreover, provide a compact, efficient and effective apparatus, by providing a

cooling apparatus, for cooling the exhaust gas exhausted from the catalyst layer, under the catalyst layer. See each of claims 1, 15, 21 and 22.

To emphasize, in order to decompose a perfluoride compound by making use a catalyst, either water or steam is necessary to be included with the perfluoride compound. Note, for example, Equations (2) and (3) on page 19 of Appellants' specification. However, where the exhaust gas, supplied to the catalyst layer, contains a silicon component and when either water or steam is added to the exhaust gas, a reaction as indicated in Equation (1) in the second full paragraph on page 15 of Appellants' specification occurs, and silicon dioxide in the form of solid particulate is produced. When the silicon dioxide in the form of solid particulate is introduced to the catalyst layer, void space in the catalyst, which is filled in the catalyst layer, is clogged, and, further, gaps formed among the catalyst members are also clogged. Thereby, the active surface area of the catalyst is disadvantageously reduced; and, due thereto, the decomposing reaction of the perfluoride compound is restricted. Note, for example, the paragraph bridging pages 22 and 23, and the first full paragraph on page 23, of Appellants' specification.

According to the present invention, this clogging problem is substantially avoided, by removing the silicon component contained in the exhaust gas in the silicon component removing apparatus, and wherein any one of water and steam is added to the exhaust gas after the exhaust gas has been exhausted from the silicon component removing apparatus. As can be appreciated, since the silicon component has already been removed, formation of solid silicon particulate is avoided upon adding the water or steam, whereby decomposing efficiency of the perfluoride is enhanced. Note, for example, page 23, lines 8-25, of Appellants'

specification. See also the paragraph bridging pages 15 and 16 of Appellants' specification.

In addition, by providing the cooling apparatus at a location below the catalyst layer, the gas including decomposed perfluoride compound can easily and effectively be cooled in a compact, relatively small structure, providing advantageous results especially where the apparatus is provided in a relatively expensive (in terms of volume occupied) semiconductor manufacturing clean room.

Thus, through use of the silicon component removing apparatus in the processing apparatus of the present invention including use of the catalyst layer, effective decomposition of the perfluoride compound without adverse effects due to the silicon component in the exhaust gas is achieved. And, moreover, through use of the cooling apparatus located as in the present claims, effective and efficient location of the apparatus, occupying a minimal area, can be achieved.

Rossin, et al. discloses a catalytic process particularly for the treatment of perfluoroalkanes. The process includes contacting the perfluoroalkane with aluminum oxide at a temperature ranging from about 400°C to about 1,000°C. See column 2, lines 53-65. Note also column 3, lines 8-11, describing that according to an embodiment the perfluoroalkane is contacted with aluminum oxide in the presence of water and an oxidizing agent. Note also column 5, lines 13-21.

It is respectfully submitted that Rossin, et al. discloses a catalytic process; and it is respectfully submitted that this reference would have neither disclosed nor would have suggested the apparatus as in the present claims, including the cooling apparatus located as in the present claims, or, in combination with, e.g., the heating apparatus and catalyst layer, the silicon component removing apparatus for

removing a silicon component from an exhaust gas containing a perfluoride compound and the silicon component.

Importantly, it is respectfully submitted that Rossin, et al. does not address, nor would have suggested, the problem of clogging of the catalyst layer as addressed by the present invention, and would have neither disclosed nor would have suggested the presently claimed invention including the silicon component removing apparatus, provided as in the present claims (for example, in which at least one of water and steam is added after the exhaust gas has exited the silicon component removing apparatus), and advantages thereof as in the present invention.

As will be seen in the following, it is respectfully submitted that no reference discloses, or would have suggested, the problem addressed by the present invention, of clogging of the catalyst by solid particulate produced from a silicon component of the exhaust gas, or would have disclosed or suggested the solution to the problem, of including the silicon component removing apparatus as in the present invention. Surely, taking the present invention as a whole, including the problem addressed by the present invention and solution thereto, the teachings of the applied prior art would have neither disclosed nor would have suggested the present invention.

It is respectfully submitted that the teachings of Tom, et al. would not have rectified the deficiencies of the teachings of Rossin, et al., such that the presently claimed invention as a whole (including the problem addressed and solution thereto) would have been obvious to one of ordinary skill in the art.

Tom, et al. discloses a method and apparatus for concentration and recovery of halocarbons from effluent gas streams, the gas streams including a carrier gas,

halocarbons, by-products generated from a process employing the halocarbons and producing by-products, and optionally contaminated process gasses. The method includes contacting the gas stream with at least one scrubber to remove the by-products from the gas stream, thereby yielding a first effluent gas mixture containing the halocarbon and being substantially free of the by-products, the first effluent gas mixture being subjected to a process for removing the halocarbon from the effluent gas mixture and concentrating the same for a subsequent recovery of the halocarbon. See column 4, lines 17-30. Note also column 5, lines 14-18; and the paragraph bridging columns 10 and 11.

Initially, note that the purpose of Tom, et al. is to recover halocarbon; in contrast, the purpose of Rossin, et al. is to decompose perfluoride. It is respectfully submitted that one of ordinary skill in the art concerned with in Rossin, et al. looking to decompose perfluoride, would not have looked to the teachings of Tom, et al. Taking the teachings of Rossin, et al. as a whole and of Tom, et al. as a whole, as required under 35 USC 103, it is respectfully submitted that utilizing the teachings of Tom, et al. with the teachings of Rossin, et al., decomposing the product, would destroy Tom, et al. for its intended purpose. Accordingly, the combination of teachings of references as applied by the Examiner is improper. See In re Ratti, 123 USPQ 349 (CCPA 1959).

Again emphasizing that Rossin, et al. is concerned with decomposing the perfluoride, while Tom, et al. discloses a system wherein the halocarbons are recovered, it is respectfully submitted that there would have been no proper motivation for combining the teachings of Rossin, et al. and Tom, et al. as applied by the Examiner. Of course, without proper motivation, the combination of teachings of the references as applied by the Examiner is improper under 35 USC 103.

Moreover, it is again emphasized that neither of Rossin, et al. or Tom, et al., disclose contamination problems in connection with a catalytic process wherein perfluoride is decomposed; and it is respectfully submitted that no proper motivation has been presented by the Examiner for combining the teachings of Rossin, et al. and Tom, et al., absent hindsight use of Appellants' disclosure, which of course is improper under the requirements of 35 USC 103.

In any event, even assuming, arguendo, that the teachings of the applied references were properly combinable, such teachings would have neither disclosed nor would have suggested the presently claimed subject matter, including, inter alia, the silicon component removing apparatus; and/or wherein the heating apparatus is provided for heating the exhaust gas, to which one of water and steam is added after the exhaust gas has exited the silicon component removing apparatus; and/or the catalyst layer used in connection with exhaust gas exhausted from the heating apparatus; and/or wherein the cooling apparatus is arranged below the catalyst layer, and advantages thereof.

The Examiner contends, in the first full paragraph on page 4 of the Final Office Action mailed March 1, 2005, that it would have been obvious to use a wet scrubber to remove contaminants from the gas stream, as taught by Tom, et al., before contacting the gas stream with a catalyst bed, in the process of Rossin, et al. However, it must be emphasized that Rossin, et al. provided no disclosure with respect to contaminants in the gas stream, much less silicon components therein. It is respectfully submitted that only through hindsight use of Appellants' original disclosure, which of course is improper under 35 USC 103, is there a disclosure of problems arising in connection with clogging of the catalyst due to solid produced from the silicon component of the exhaust gas. It is respectfully submitted that the

Examiner has provided no proper motivation for combining the teachings of Rossin, et al. and Tom, et al.

Furthermore, it is again emphasized that Tom, et al. provides no disclosure with respect to removal of silicon components. It is respectfully submitted that the combined teachings of Rossin, et al. and of Tom, et al. would have neither disclosed nor would have suggested the silicon component removing apparatus for removing a silicon component from an exhaust gas containing a perfluoride compound and the silicon component, as in the present claims; and, moreover, again emphasizing that the teachings of Rossin, et al. and of Tom, et al. would not have disclosed or suggested problems in connection with silicon components in the exhaust gas, much less the existence of such component in the exhaust gas, it is respectfully submitted that the combined teachings of Rossin, et al. and of Tom, et al. would have neither disclosed nor would have suggested the apparatus as in the present claims, including the heating apparatus for heating the exhaust gas containing the perfluoride compound, to which at least one of water and steam is added after the exhaust gas has exited the silicon component removing apparatus.

Appellants respectfully traverse the conclusion by the Examiner on page 3 of the Final Office Action mailed March 1, 2005, that one of ordinary skill in the art would readily arrange the "scrubber means below the catalyst region", for the purpose of minimizing space that would normally be occupied by the horizontally adjacent scrubber/catalyst region components of the processing apparatus, resulting in a more compact processing apparatus. Contrary to this contention by the Examiner, note that the present claims recite that a cooling apparatus is located below the catalyst layer. It is respectfully submitted that the Examiner has not even addressed this recitation of the cooling apparatus being located below the catalyst, in

contending that one of ordinary skill in the art would readily arrange the scrubber means below the catalyst region.

It is acknowledged that in the paragraph bridging pages 2 and 3 of the Final Office Action mailed March 1, 2005, the Examiner contends that the acid removing scrubber in Rossin, et al. would perform the same function as a cooler. This unsubstantiated contention is respectfully traversed. Note that the Examiner has not established that an acid removing scrubber would inherently act as a cooling apparatus as in the present claims. Moreover, the Examiner has not even alleged that the acid removing scrubber in Rossin, et al. would have the same structure as a cooling apparatus as recited in the present claims. Surely, the Examiner has not established that the acid removing scrubber as in Rossin, et al. would have disclosed or suggested the cooling apparatus as in the present claims.

In the present invention, the acid gas removing apparatus 98 is a component after cooling apparatus 22 (see Fig. 3 and the description on page 21, lines 9-26, of Appellants' specification). This constitutes some evidence that the disclosure of the acid removing scrubber in Rossin, et al. would have neither taught nor would have suggested the cooling apparatus as in the present claims.

Furthermore, it is noted that claim 4 recites that the silicon component removing apparatus comprises a spray apparatus for spraying water. As discussed previously, it has been shown that neither of Rossin, et al. or Tom, et al. would have disclosed or would have suggested a silicon component removing apparatus. Clearly, the combined teachings of these references would have neither disclosed nor would have suggested wherein such silicon component removing apparatus includes a spray apparatus for spraying water.

In addition, it is respectfully submitted that the Examiner has pointed to no teachings in either of Rossin, et al. and/or Tom, et al., describing a cooling apparatus, the Examiner merely contending that the acid scrubber in Rossin, et al. would also perform the function as a cooler. As the Examiner has not pointed to any teachings in Rossin, et al. and/or Tom, et al. disclosing the silicon component removing apparatus or cooling apparatus, clearly the combined teachings of these references would have neither disclosed nor would have suggested the cooling apparatus and/or silicon component removing apparatus as in claims 5 and 6; and/or the check valve provided in a path conducting the exhaust gas from the silicon component removing apparatus to the heating apparatus, as in claim 7; and/or the structure including the cooling apparatus being formed in an integral body structure as in claim 8; and/or the integral body structure including the cooling apparatus as in claim 16.

Rejection of Claim 10 Under 35 USC 103(a) over Rossin, et al. in view of Tom, et al., and Further in view of Imamura or Izumikawa, et al.

It is respectfully submitted that the combined teachings of Rossin, et al., Tom, et al., and either Imamura or Izumikawa, et al. would have neither taught nor would have suggested such apparatus as in claim 10, having the features as in claim 1, and additionally including, inter alia, wherein a heat exchanger is provided between the catalyst layer and the cooling apparatus.

Initially, attention is respectfully directed to previous discussion in connection with the subject matter claimed in claim 1. For the same reason that the subject matter of claim 1 patentably distinguishes over the teachings of the prior art, it is

respectfully submitted that claim 10 patentably distinguishes over the teachings of the prior art.

Additionally, Imamura discloses a method for effectively removing harmful and toxic substances of a generally highly metal-corrosive exhaust gas with or without dust discharged from a semiconductor manufacturing process, the method including, inter alia, heating a water-scrubbed exhaust gas to thermally decompose a thermally decomposable component contained therein and removing dust generated by the thermal decomposition from the thermally decomposed exhaust gas by way of water scrubbing to render the thermally decomposed exhaust gas into a clean exhaust gas. See column 2, lines 45-50. This patent discloses use of a heat exchanger for heating the water-scrubbed exhaust gas by utilizing heat of the thermally decomposed exhaust gas of high temperature. See column 3, lines 38-41, in connection with a third feature of the apparatus described in Imamura which is disclosed most generally at column 3, lines 28-54.

Izumikawa, et al. discloses a process for decomposing fluorocarbons, by contacting perfluorocarbon or hydrofluorocarbon gas with a reagent including carbon and at least one alkaline earth metal, at a temperature of 300°C or higher and in the presence of 20 vol% or less (but not 0%) of gaseous oxygen. See column 1, lines 59-63. Fig. 6 of this patent shows heat exchange between treatment gas prior to entering the reactor and exhaust gas which has left the reactor, during the process described in the patent.

Even assuming, arguendo, that the teachings of Imamura or Izumikawa, et al. were properly combinable with the teachings of Rossin, et al. and Tom, et al., it is respectfully submitted that such combined teachings would have neither disclosed nor would have suggested the presently claimed structure, including the heat

exchanger provided between the catalyst layer and the cooling apparatus; and/or the other features of the present invention as discussed previously in connection with claim 1, including, inter alia, the silicon component removing apparatus, and the heating apparatus for heating the exhaust gas, to which at least one of water and steam is added after the exhaust gas has been exhausted from the silicon component removing apparatus, or the catalyst layer for decomposition in connection with exhaust gas exhausted from the heating apparatus, or the location of the cooling apparatus below the catalyst layer, and advantages thereof as discussed in the foregoing.

Rejection of Claims 13 and 14 Under 35 USC 103(a) over Rossin, et al. in view of Tom, et al., and Further in view of Holst, et al.

It is respectfully submitted that the subject matter of claims 13 and 14, which each include the subject matter of claims 1 and 4, patentably distinguish over the teachings of references as applied in rejecting these claims, for the same reasons that claims 1 and 4 patentably distinguish over the teachings of the applied references, as discussed previously. Specifically, the combined teachings of Rossin, et al., Tom, et al. and Holst, et al. as applied by the Examiner would have neither taught nor would have suggested the presently claimed subject matter as in claims 13 and 14, including, inter alia, the silicon component removing apparatus; and/or the heating apparatus for heating the exhaust gas containing the perfluoride compound, to which at least one of water and steam is added after the exhaust gas has been exhausted from the silicon component removing apparatus; and/or the catalyst layer for decomposition in connection with exhaust gas exhausted from the heating apparatus; and/or the cooling apparatus, located below the catalyst layer;

and/or (see claim 4) wherein the cooling apparatus includes a spray apparatus for spraying cooling water for cooling the exhaust gas.

Additionally, it is respectfully submitted that the combined teachings of Rossin, et al. , Tom, et al. and Holst, et al. would have neither disclosed nor would have suggested the apparatus as expressly claimed in claims 13 and 14, including the exhaust gas inlet portion for supplying the exhaust gas to the silicon component removing apparatus, extended into the silicon component removing apparatus, and/or the gas outlet opening of the exhaust gas inlet portion being provided a position lower than spray apparatus of the silicon component removing apparatus, with the gas outlet opening being oriented downward in the silicon component removing apparatus (see claim 13); or wherein a diffusion portion for diffusing sprayed water from the spray apparatus of the silicon component removing apparatus is provided inside the silicon component removing apparatus between the spray apparatus of the silicon component removing apparatus and the exhaust gas inlet portion (see claim 14). Surely, since the combined teachings of the applied references do not disclose, nor would have suggested, the silicon component removing apparatus, such teachings would have neither disclosed nor would have suggested the exhaust gas inlet portion or gas outlet opening, with respect to the silicon component removing apparatus; and/or the diffusion portion inside the silicon component removing apparatus, as in claims 13 and 14.

Holst, et al. discloses an integrated effluent gas treatment system configured to include in a unitary housing as a compact point of use device, various components, such integrated effluent gas treatment system possibly utilizing a pre-scrubber, an oxidizer and scrubber assembly, in connection with a clog-resistant inlet

structure for introducing a fluid stream to the assembly from an upstream process facility. See column 3, line 50, to column 4, line 12.

It is respectfully submitted that Holst, et al., either alone or in combination with the teachings of the other applied references, would not have disclosed, nor would have suggested, the silicon component removing apparatus, much less specifics thereof; and, particularly in view thereof, it is respectfully submitted that the combined teachings of the applied references would have neither disclosed nor would have suggested the subject matter of claims 13 and 14, having specific structure with respect to the silicon component removing apparatus.

Rejection of Claims 2, 11, 12, 17-20, 23 and 24 Under 35 USC 103(a) over Rossin, et al. in view of Tom, et al., and Further in view of Smith, et al.

Appellants respectfully traverse the rejection of claims 2, 11, 12, 17-20, 23 and 24 under 35 USC 103(a) as unpatentable over Rossin, et al., in view of Tom, et al. and further in view of Smith, et al.

It is respectfully submitted that the combined teachings of Rossin, et al., Tom, et al. and Smith, et al. would have neither taught nor would have suggested apparatus as in claims 2, 11, 12, 17-20, 23 and 24, including the silicon component removing apparatus; and/or the heating apparatus for heating the exhaust gas containing the perfluoride compound, to which at least one of water and steam is added after the exhaust gas has exited from the silicon component removing apparatus; and/or the catalyst layer for decomposition in connection with exhaust gas exhausted from the heating apparatus; and/or the cooling apparatus arranged in the casing at a position below the catalyst layer; and/or the cooling water supplying apparatus for supplying cooling water to the silicon component removing apparatus

for contacting with the exhaust gas, the cooling water having been supplied to the cooling apparatus and used for cooling the exhaust gas (see claims 23 and 24).

Furthermore, it is respectfully submitted that the combined teachings of Rossin, et al., Tom, et al. and Smith, et al. would have neither taught nor would have suggested the apparatus as discussed previously in connection with claim 1, and/or additional features of the temperature detector and controller for controlling the heating apparatus based on the temperature detected by the temperature detector, as in claim 2; and/or wherein, inter alia, the cooling apparatus, together with the heater and the casing having the catalyst layer cartridge removably attached thereto, are formed in an integral body structure (see claim 11); and/or arrangement of the structure in the casing, including the cooling apparatus, as in claims 18 and 20.

Smith, et al. discloses chemical exhaust gas conditioning units operating in two main sections and an optional third section, the effluent gasses passing first through a section in which the active chemical component is elemental silicon and second through a section in which the active component is lime or soda lime. This patent further discloses that, optionally, the gas can be passed through a third section in which the active components are lime and copper oxides. See column 2, lines 5-13.

Even assuming, arguendo, that the teachings of Smith, et al. where properly combinable with the teachings of Rossin, et al. and of Tom, et al., as applied by the Examiner, it is respectfully submitted that these combined teachings would have neither disclosed nor would have suggested the presently claimed subject matter, including the silicon component removing apparatus; and/or heating apparatus for heating the exhaust gas, to which at least one of water and steam is added after the exhaust gas has exited the silicon component removing apparatus; and/or the

catalyst layer used with the exhaust gas exhausted from the heating apparatus; and/or the cooling apparatus, arranged in the casing at a location below the catalyst layer, as discussed previously. In addition, such combined teachings would have neither disclosed nor would have suggested such apparatus, and further including the cooling water supplying apparatus as in claims 23 and 24; and/or the other features of the present invention as discussed previously.

The Examiner contends that Smith, et al. teaches a heated catalyst "that includes a heater surrounding a catalyst bed that is contained in a removable cartridge casing". However, note that the present claims recite a heating apparatus; and a catalyst layer filled with a catalyst for decomposing perfluoride compound contained in the exhaust gas exhausted from the heating apparatus. As interpreted by the Examiner, wherein Smith, et al. discloses the heater surrounding the catalyst bed, such disclosure would have taught away from the present invention including the catalyst layer for decomposing perfluoride compound contained in the exhaust gas exhausted from the heating apparatus.

CONCLUSION

As seen in the foregoing, it is respectfully submitted that the combined teachings of the references as applied by the Examiner would have neither taught nor would have suggested the apparatus of the claims on appeal. The teachings of Rossin, et al. and of Tom, et al., applied in each of the prior art references, would not have been properly combinable under the guidelines of 35 USC 103; and, moreover, even if properly combinable, and combinable with the teachings of the other applied references, would have neither taught nor would have suggested the presently claimed invention. Accordingly, it is respectfully submitted that the Final rejection of

the claims on appeal is improper. Reversal of the rejection of the claims on appeal, by the Honorable Board, in due course, is respectfully requested.

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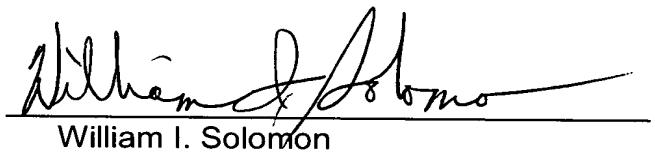
Respectfully submitted,

ANTONELLI, TERRY, STOUT & KRAUS, LLP

By 
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CLAIMS APPENDIX

1. A perfluoride compound processing apparatus, comprising:

a silicon component removing apparatus for removing a silicon component from an exhaust gas containing a perfluoride compound and said silicon component,

a heating apparatus for heating said exhaust gas containing said perfluoride compound, to which at least one of water and steam is added after said exhaust gas has been exhausted from said silicon component removing apparatus,

a catalyst layer filled with a catalyst for decomposing said perfluoride compound contained in said exhaust gas exhausted from said heating apparatus, and

a cooling apparatus, located below said catalyst layer, for cooling said exhaust gas exhausted from said catalyst layer.

2. A perfluoride compound processing apparatus as claimed in claim 1, which further comprises:

a temperature detector for detecting a temperature of said exhaust gas exhausted from said catalyst layer, and

a controller for controlling said heating apparatus based on the temperature detected by the temperature detector.

3. A perfluoride compound processing apparatus as claimed in claim 1, which further comprises:

an acidic gas removing apparatus for removing acidic gas contained in said exhaust gas exhausted from said cooling apparatus.

4. A perfluoride compound processing apparatus as claimed in claim 1, wherein said silicon component removing apparatus comprises a spray apparatus for spraying water.

5. A perfluoride compound processing apparatus as claimed in claim 4, wherein said cooling apparatus comprises a spray apparatus for spraying cooling water for cooling said exhaust gas.

6. A perfluoride compound processing apparatus as claimed in claim 5, wherein:

said silicon component removing apparatus comprises a first silicon component removing apparatus, and a second silicon component removing apparatus to which said exhaust gas from said first silicon component removing apparatus is supplied,

a first spray apparatus for spraying water provided inside said second silicon component removing apparatus, and

a second spray apparatus for spraying both water sprayed from said first spray apparatus and water sprayed from said spray apparatus of said cooling apparatus.

7. A perfluoride compound processing apparatus as claimed in claim 1, wherein a check valve, for preventing said exhaust gas from flowing back into said silicon component removing apparatus from said heating apparatus, is provided in a path conducting said exhaust gas from said silicon component removing apparatus to said heating apparatus.

8. A perfluoride compound processing apparatus as claimed in claim 1, wherein said heater, said catalyst layer, and said cooling apparatus are formed in an integral body structure in the above order.

9. A perfluoride compound processing apparatus as claimed in claim 8, wherein:

said integral body structure is formed by arranging said heater, said catalyst layer, and said cooling apparatus in a horizontal direction, and a baffle member for disturbing a flow of undecomposed perfluoride compound is provided at a portion above said catalyst layer.

10. A perfluoride compound processing apparatus as claimed in claim 1, wherein a heat exchanger for exchanging heat between the exhaust gas exhausted from said catalyst layer and water, and for generating said steam, is provided between said catalyst layer and said cooling apparatus.

11. A perfluoride compound processing apparatus as claimed in claim 1, further comprising:

a cartridge having said catalyst layer formed inside; and

a casing wherein said cartridge is removably attached,

wherein said heater, said casing, and said cooling apparatus are formed in an integral body structure in the above order.

12. A perfluoride compound processing apparatus as claimed in claim 11, further comprising a reactor which comprises said cartridge, an internal tube wherein said cartridge is contained, and said casing, and wherein said casing of said reactor is shared with a casing of said heater.

13. A perfluoride compound processing apparatus as claimed in claim 4, wherein:

an exhaust gas inlet portion for supplying said exhaust gas containing a perfluoride compound and a silicon component to said silicon component removing apparatus is extended into said silicon component removing apparatus, and

a gas outlet opening of said exhaust gas inlet portion is provided at a position lower than said spray apparatus of said silicon component removing apparatus, and said gas outlet opening is oriented downwards in said silicon component removing apparatus.

14. A perfluoride compound processing apparatus as claimed in claim 13, wherein a diffusion portion for diffusing sprayed water from said spray apparatus of said silicon component removing apparatus is provided inside said silicon component removing apparatus between said spray apparatus of said silicon component removing apparatus and said exhaust gas inlet portion.

15. An exhaust gas processing apparatus for a semiconductor manufacturing apparatus, comprising:

a silicon component removing apparatus for removing a silicon component from an exhaust gas containing a perfluoride compound and said silicon component;

a heating apparatus for heating said exhaust gas containing said perfluoride compound, to which any one of water and steam is added after said exhaust gas has been exhausted from said silicon component removing apparatus;

a catalyst layer filled with a catalyst for decomposing said perfluoride compound contained in said exhaust gas exhausted from said heating apparatus; and

a cooling apparatus, located below said catalyst layer, for cooling said exhaust gas exhausted from said catalyst layer.

16. An exhaust gas processing apparatus for a semiconductor manufacturing apparatus as claimed in claim 15, wherein:

said heating apparatus, said catalyst layer, and said cooling apparatus are formed in an integral body structure in the above order, and

said integral body structure of said heating apparatus, said catalyst layer, and said cooling apparatus is installed in a building where said semiconductor manufacturing apparatus is installed.

17. A perfluoride compound processing apparatus, comprising:

a silicon component removing apparatus for removing a silicon component from an exhaust gas containing a perfluoride compound and said silicon component;

a heating apparatus, downstream of the silicon component removing apparatus in a direction of flow of the exhaust gas, for heating said exhaust gas containing said perfluoride compound, to which at least one of water and steam is added after the exhaust gas has exited said silicon component removing apparatus, the heating apparatus being arranged in a casing;

a catalyst layer filled with a catalyst for decomposing said perfluoride compound contained in heated exhaust gas from the heating apparatus, the catalyst layer being arranged detachably in the casing at a downstream side of said heating apparatus in the direction of flow of the exhaust gas; and

a cooling apparatus arranged in the casing at a location below said catalyst layer and at a downstream side from the catalyst layer, in the direction of flow of the exhaust gas, for cooling said exhaust gas containing a decomposed gas generated by decomposition of said perfluoride compound by said catalyst layer.

18. A perfluoride compound processing apparatus as claimed in claim 17, wherein:

said heating apparatus is arranged in an upper region of said casing,

said catalyst layer is arranged in a lower region of said casing in a manner that said catalyst layer is removable in a lower direction from the casing, and

said cooling apparatus is arranged detachably in the casing at the lower region of the casing.

19. A perfluoride compound processing apparatus, comprising:

a silicon component removing apparatus for removing a silicon component from an exhaust gas containing a perfluoride compound and said silicon component, exhausted from a semiconductor manufacturing apparatus;

a heating apparatus, downstream of the silicon component removing apparatus in a direction of flow of the exhaust gas, for heating said exhaust gas containing said perfluoride compound, to which at least one of water and steam is added after the exhaust gas has exited said silicon component removing apparatus,

the heating apparatus being arranged in a casing;

a catalyst layer filled with a catalyst for decomposing said perfluoride compound contained in heated exhaust gas from the heating apparatus, the catalyst layer being arranged detachably in the casing at a downstream side of said heating apparatus in the direction of flow of the exhaust gas; and

a cooling apparatus arranged in the casing below the catalyst layer, in the direction of flow of the exhaust gas, for cooling said exhaust gas containing a decomposed gas generated by decomposition of said perfluoride compound by said catalyst layer.

20. A perfluoride compound processing apparatus as claimed in claim 19, wherein:

said heating apparatus is arranged in an upper region of said casing,

said catalyst layer is arranged in a lower region of said casing in a manner that said catalyst layer is removable in a lower direction from the casing, and

said cooling apparatus is arranged detachably in the casing at the lower region of the casing.

21. A perfluoride compound processing apparatus, comprising:

a silicon component removing apparatus for removing a silicon component from an exhaust gas containing a perfluoride compound and said silicon component;

a heating apparatus for heating said exhaust gas containing said perfluoride compound, to which at least one of water and steam is added after said exhaust gas has been exhausted from said silicon component removing apparatus;

a catalyst layer filled with a catalyst for decomposing said perfluoride

compound contained in said exhaust gas exhausted from said heating apparatus;

a cooling apparatus arranged at a portion below said catalyst layer for cooling said exhaust gas exhausted from said catalyst layer; and

a cooling water supplying apparatus for supplying cooling water to said silicon component removing apparatus for contacting with said exhaust gas, the cooling water having been supplied to said cooling apparatus and used for cooling said exhaust gas.

22. A perfluoride compound processing apparatus for a semiconductor manufacturing apparatus, comprising:

a silicon component removing apparatus for removing a silicon component from an exhaust gas containing a perfluoride compound and said silicon component;

a heating apparatus for heating said exhaust gas containing said perfluoride compound, to which any one of water and steam is added after said exhaust gas has been exhausted from said silicon component removing apparatus;

a catalyst layer filled with a catalyst for decomposing said perfluoride compound contained in said exhaust gas exhausted from said heating apparatus;

a cooling apparatus arranged at a portion below said catalyst layer for cooling said exhaust gas exhausted from said catalyst layer; and

a cooling water supplying apparatus for supplying cooling water to said silicon component removing apparatus for contacting with said exhaust gas, the cooling water having been supplied to said cooling apparatus and used for cooling said exhaust gas.

23. A perfluoride compound processing apparatus, comprising:

a silicon component removing apparatus for removing a silicon component from an exhaust gas containing a perfluoride compound and said silicon component;

a heating apparatus, downstream of the silicon component removing apparatus in a direction of flow of the exhaust gas, for heating said exhaust gas containing said perfluoride compound, to which at least one of water and steam is added after the exhaust gas has exited from said silicon component removing apparatus, the heating apparatus being arranged in a casing;

a catalyst layer filled with a catalyst for decomposing said perfluoride compound contained in said exhaust gas exhausted from said heating apparatus, the catalyst layer being arranged detachably in the casing at a downstream side of said heating apparatus in the direction of flow of the exhaust gas;

a cooling apparatus arranged in the casing at a portion below said catalyst layer in the direction of flow of the exhaust gas for cooling said exhaust gas containing a decomposed gas generated by decomposition of said fluoride compound by said catalyst layer; and

a cooling water supplying apparatus for supplying cooling water to said silicon component removing apparatus for contacting with said exhaust gas, the cooling water having been supplied to said cooling apparatus and used for cooling said exhaust gas.

24. A perfluoride compound processing apparatus, comprising:

a silicon component removing apparatus for removing a silicon component from an exhaust gas containing a perfluoride compound and said silicon component, exhausted from a semiconductor manufacturing apparatus;

a heating apparatus, downstream of the silicon component removing apparatus in a direction of flow of the exhaust gas, for heating said exhaust gas containing said perfluoride compound, to which at least one of water and steam is added after the exhaust gas has exited from said silicon component removing apparatus, the heating apparatus being arranged in a casing;

a catalyst layer filled with a catalyst for decomposing said perfluoride compound contained in said exhaust gas exhausted from said heating apparatus, the catalyst layer being arranged detachably in the casing at a downstream side of said heating apparatus in the direction of flow of the exhaust gas;

a cooling apparatus arranged in the casing at a portion below said catalyst layer in the direction of flow of the exhaust gas for cooling said exhaust gas containing a decomposed gas generated by decomposition of said fluoride compound by said catalyst layer; and

a cooling water supplying apparatus for supplying cooling water to said silicon component removing apparatus for contacting with said exhaust gas, the cooling water having been supplied to said cooling apparatus and used for cooling said exhaust gas.